

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for PRELIM DESIGN 2.SWS

Pipe Sizes PRELIM DESIGN 2 Manhole Sizes PRELIM DESIGN 2

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.326	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for PRELIM DESIGN 2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	38.844	2.005	19.4	0.125	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.343	1.051	15.5	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	18.483	0.231	80.0	0.107	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	20.338	1.356	15.0	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	28.206	1.659	17.0	0.117	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	28.665	1.686	17.0	0.097	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	21.095	0.251	84.0	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	20.427	0.600	34.0	0.104	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	15.882	0.529	30.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	17.418	0.581	30.0	0.066	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	64.06	4.22	183.600	0.125	0.0	0.0	0.0	2.99	118.8	21.7
S1.001	63.62	4.30	181.595	0.133	0.0	0.0	0.0	3.34	132.6	22.9
S2.000	64.10	4.21	180.775	0.107	0.0	0.0	0.0	1.46	58.2	18.6
S1.002	63.08	4.40	180.544	0.266	0.0	0.0	0.0	3.40	135.0	45.4
S1.003	62.44	4.52	179.113	0.383	0.0	0.0	0.0	3.83	270.8	64.8
S1.004	61.80	4.65	177.454	0.480	0.0	0.0	0.0	3.83	270.8	80.3
S1.005	63.90	4.25	175.568	0.000	4.5	0.0	0.0	1.43	56.8	4.5
S1.006	63.22	4.37	175.242	0.104	4.5	0.0	0.0	2.70	191.1	22.3
S1.007	62.73	4.46	174.642	0.104	4.5	0.0	0.0	2.88	203.7	22.3
S1.008	62.21	4.56	174.113	0.170	4.5	0.0	0.0	2.88	203.7	33.1

Network Design Table for PRELIM DESIGN 2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	14.194	0.946	15.0	0.051	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	15.963	0.872	18.3	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	13.210	0.777	17.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	11.718	0.781	15.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	33.134	0.221	149.9	0.124	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.011	19.152	1.277	15.0	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	36.794	2.453	15.0	0.144	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	43.874	1.994	22.0	0.165	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	39.200	2.613	15.0	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	14.416	0.961	15.0	0.071	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	10.085	0.206	49.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.000	11.372	0.038	300.1	0.000	4.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.013	4.730	0.075	63.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	13.030	0.250	52.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.015	5.214	0.060	86.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	64.89	4.07	175.425	0.051	0.0	0.0	0.0	3.40	135.0	9.0
S3.001	64.40	4.16	174.479	0.103	0.0	0.0	0.0	3.07	122.2	18.0
S1.009	61.92	4.62	173.532	0.273	4.5	0.0	0.0	3.83	270.9	50.3
S1.010	61.68	4.67	172.755	0.300	4.5	0.0	0.0	4.08	288.4	54.6
S4.000	62.91	4.43	172.194	0.124	0.0	0.0	0.0	1.28	90.6	21.1
S1.011	61.29	4.75	171.973	0.443	4.5	0.0	0.0	4.08	288.4	78.0
S1.012	60.55	4.90	170.696	0.587	4.5	0.0	0.0	4.08	288.4	100.8
S5.000	63.82	4.26	174.740	0.165	0.0	0.0	0.0	2.80	111.4	28.5
S5.001	62.79	4.45	172.746	0.258	0.0	0.0	0.0	3.40	135.0	43.9
S5.002	62.42	4.52	170.133	0.329	0.0	0.0	0.0	3.40	135.0	55.6
S5.003	62.04	4.60	169.097	0.329	0.0	0.0	0.0	2.25	159.2	55.6
S6.000	64.78	4.09	167.488	0.000	0.0	0.0	0.0	2.15	2436.7	0.0
S1.013	65.01	4.05	167.400	0.000	10.8	0.0	0.0	1.65	65.6	10.8
S1.014	64.57	4.12	167.100	0.000	10.8	0.0	0.0	2.82	448.7	10.8
S1.015	64.35	4.16	166.850	0.000	10.8	0.0	0.0	2.18	347.0	10.8

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 Checked by

Micro Drainage Network 2020.1

Simulation Criteria for PRELIM DESIGN 2.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.326		

Online Controls for PRELIM DESIGN 2.SWS

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 10.2

Unit Reference	MD-SHE-0091-4500-1600-4500
Design Head (m)	1.600
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	91
Invert Level (m)	175.568
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	4.5
Flush-Flo™	0.399	4.1
Kick-Flo®	0.817	3.3
Mean Flow over Head Range	-	3.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)						
0.100	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.7	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.1
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.013, Volume (m³): 24.3

Unit Reference	MD-SHE-0154-1500-2400-1500
Design Head (m)	2.400
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	154
Invert Level (m)	167.400
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

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Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.013, Volume (m³): 24.3

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	15.0
Flush-Flo™	0.673	14.6
Kick-Flo®	1.376	11.5
Mean Flow over Head Range	-	12.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)						
0.100	5.5	1.200	13.2	3.000	16.7	7.000	25.0
0.200	11.7	1.400	11.6	3.500	17.9	7.500	25.9
0.300	13.1	1.600	12.4	4.000	19.1	8.000	26.7
0.400	13.9	1.800	13.1	4.500	20.2	8.500	27.5
0.500	14.4	2.000	13.7	5.000	21.3	9.000	28.2
0.600	14.6	2.200	14.4	5.500	22.3	9.500	29.0
0.800	14.5	2.400	15.0	6.000	23.2		
1.000	14.1	2.600	15.6	6.500	24.1		

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Storage Structures for PRELIM DESIGN 2.SWS

Tank or Pond Manhole: S6, DS/PN: S1.005

Invert Level (m) 175.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	175.0	1.500	175.0	1.501	0.0

Tank or Pond Manhole: S26, DS/PN: S6.000

Invert Level (m) 167.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	210.0	2.100	210.0	2.101	0.0